

## REMARKS

The Examiner rejected claims 1 through 5 and 7-8 under 35 U.S.C. §103(a) as being unpatentable over Watanabe et al. in view of DE3,629,740. The Examiner indicated that Watanabe discloses a base spring having a box-like backup spring 10 having a divided overlap fourth wall with a connecting lug formed on one wall section and a recessed formed on the other wall section, and that the wall sections overlap over the full length of the backup spring. Applicants disagree with the characterization of Watanabe as given by the Examiner.

Rather, Applicants believe that the Watanabe terminal as shown in any of Figures 1 through 4 shows a one-piece terminal, not a socket consisting of a backup spring and a base spring. As shown in Figure 4, Watanabe is stamped from a single sheet of material and folded into the configuration having a cross section of Figure 3. It is clear from Figure 3 that the contact parts are formed from reverse bent contact portion 12 in combination with the projection of 13a. Thus, there is no backing up of these spring parts as is provided by a backup spring.

Taking into account that the Examiner admits that Watanabe fails to disclose two lugs, Watanabe does not disclose or suggest a socket contact composing of a backup spring and a base spring, where the backup spring is secured by means of two lugs passing through recesses and being bent over wherein two wall sections overlap over the full length of the backup spring. In contrast to the Examiner's point of view, a skilled person would have had no reason to modify the socket contact of Watanabe et al. in accordance with certain teaching shown in an additionally cited DE-740. According to Watanabe, Figures 5 and 6 disclose prior art according to which a projection 113a is formed at each of the two opposing edges of the upper wall 113. Thus, to avoid a deformation of the projections 113a (see column 4 of Watanabe), Watanabe provides for overlapping upper wall portions, where a projection 13b is engaged in an engaging hole 17, as shown in Figures 1 and 4 of Watanabe. Therefore, a skilled person has no reason for modifying this structure in view of DE-740.

The Examiner also rejected claim 8 under 35 U.S.C. §103(a) as being unpatentable over Watanabe et al. in view of DE-740 and further in view of Seko. Given the flawed characterization of Watanabe et al., it is not clear how the incorporation of the forward portion wall 14 would add to obviating claim 8, indicating that the upper wall section of the backup spring has a material thickness of the lower wall section.

The Examiner also rejection claim 6 under 35 U.S.C. §103(a) as being unpatentable over Watanabe et al. in further view of DE-740 and further in view of Seko. Given the fact that neither Watanabe nor Seko show backup springs, it is not clear what the addition of Seko adds to the rejection under 35 U.S.C. §103(a).

The Examiner also rejected claim 9 under 35 U.S.C. §103(a) as being unpatentable over Watanabe in view of DE-740 and further in view of Myer. The Examiner added Myer for its polarizing member 27, as this did not exist in any of the base references. Once again, given the fact that neither Watanabe nor Myer show backup springs, it is not clear how the addition of a polarizing member to the base contact not to a backup spring obviates claim 9.

The Examiner also rejected claim 10 under 35 U.S.C. §103(a) as being unpatentable over Watanabe in view of DE-740 and further in view of Egenolf. The Examiner indicated that Watanabe does not have the folding lugs on opposing second and third walls of the backup spring, but that Egenolf shows folding legs 77 and 79. Once again, given the fact that Watanabe does not show a backup spring, it is not clear how the addition of the folding legs 77 and 79 to the base spring of Watanabe would obviate claim 10.

The Examiner also rejected claims 11 through 13 and 15 under 35 U.S.C. §103(a) as being unpatentable over Kakuta et al. in view of German '047. Once again, the Examiner mischaracterizes Kakuta as having a base spring and a box-like backup spring having a divided overlapped fourth wall. Kakuta does not show a contact having a backup spring, but rather is almost identical to Watanabe, in that it has a reversely bent contact portion at 4, and an opposed contact portion formed in the upper and opposed wall. Notwithstanding that Kakuta does not have a backup spring at all, the Examiner points to German utility model '047 for two connecting points, that is, lugs 55 and 56. However, these lugs are on the bottom side of the backup spring as shown in Figure 23, rather than on two overlapping top walls. As shown in Figure 19, no top walls exist at all, rather the walls 21 and 22 are folded inwardly, rather than forming overlapping wall portions with two connecting lugs connecting the walls. Thus, even if the Examiner is correct, and that Kakuta together with German utility model '047 are combinable, they still do not obviate to the structure of claims 11 through 13.

The Examiner indicated that with respect to claim 14, Kakuta discloses the invention substantially as claimed except for recesses formed as U-shaped recesses. The

Examiner indicated that it would have been obvious to modify the structure of Kakuta by including the U-shaped recess. Given the mischaracterization of Kakuta, it would not be obvious in light of Kakuta to modify any of Kakuta's structure to form a U-shaped recess in the backup spring wall.

The Examiner rejected claim 16 under 35 U.S.C. §103(a) as being unpatentable over Kakuta and German utility model '047, further in view of Seko. As mentioned above, as neither Kakuta nor Seko show backup springs, it is not clear how Seko's notches in combination with Kakuta and German utility model '047 would obviate claim 16.

The Examiner rejected claim 17 under 35 U.S.C. §103(a) as being unpatentable over Kakuta and German utility model '047 in view of Buddrus et al. Once again, as Kakuta does not show a backup spring, it is not clear how the addition of Buddrus having clamp 57 would obviate claim 17.

The Examiner rejected claim 18 under 35 U.S.C. §103(a) as being unpatentable over Kakuta et al. and German utility model '047, and further in view of DE-740. The Examiner indicated that it would be obvious to modify Kakuta to include the structured crank of DE-740. Given that Kakuta does not show a backup spring at all, the addition of DE-740 does not obviate claim 18.

The Examiner rejected claim 19 under 35 U.S.C. §103(a) as being unpatentable over Kakuta et al. and German utility model '047, and further in view of Myer. As Myer does not have a backup spring at all, the addition of Myer with Kakuta, where Kakuta does not have a backup spring, does not obviate claim 19.

The Examiner also rejected claim 20 under 35 U.S.C. §103(a) as being unpatentable over Kakuta et al. and German utility model '047, and further in view of Egenolf. Since Kakuta does not have a backup spring, the addition of Egenolf to Kakuta could not possibly obviate claim 20.

Applicants have attached hereto a substitute specification and drawing revisions which are believed to place the application format in condition for allowance.

For all of the above-mentioned amendments and remarks, Applicants believe that claims 1 through 20 are now in condition for allowance and respectfully request early passage thereof. If necessary to effect a timely response, please consider this paper a petition for extension of time sufficient to make this response timely and charge any fees due therefore, and charge any other fees due and credit any overpayment of fees to Baker & Daniels Deposit Account No. 02-0387 (72262.20009).

Respectfully submitted,

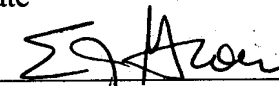


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VERSION WITH MARKINGS TO SHOW CHANGES MADE

SUBSTITUTE SPECIFICATION

BUSHING -~~SOCKET~~ CONTACT

K-55-195/6

SPECIFICATION

BACKGROUND OF THE INVENTION

[0001] The invention relates to a socket contact consisting of a back-up spring and a base spring, the back-up spring enclosing the base spring in box-like manner with a first, second, third and a divided fourth wall, and with at least two connecting lugs being formed on one wall section for connecting the wall sections of the fourth divided wall to each other in positive manner, said connecting lugs, in the direction of insertion of said socket contact, being formed in the front and rear portions of the wall sections.

SUMMARY OF THE INVENTION

[0002] Such a back-up spring is known from DE 195 36 500 C2. The back-up spring is made of a stamped and bent part, with the two top wall sections being separated from each other by a longitudinal slot for manufacturing reasons. One of the top wall sections, in the lower partial region of the longitudinal slot, is formed with a connecting lug that is bent upwardly from the top wall section by a cranked portion and extends beyond the longitudinal slot in the direction towards the opposite top wall section and overlaps the other top wall section. The connection of the connecting lug to the

other top wall section takes place either by plastic forming, i.e. plastic cold forming and pressing the connecting portion into each other using a punch, or by welding or by a completely positive connection. The publication does not suggest a concrete positive connection of the top wall sections.

[0003] DE 43 12 641 A1 discloses an electric contact bushing comprising a back-up spring in which the back-up spring also has a longitudinal slot in its bottom wall for manufacturing reasons. The bottom wall sections have abutment edges which extend in parallel along the longitudinal slot and which are not aligned in the front region of the contact bushing but rather establish a hook-type design.

[0004] This kind of positive connection, however, has the disadvantage that the hook-type connection ~~my~~ may be released in case of strong torsion or mechanical load of the back-up spring.

[0005] Furthermore, DE-UM 92 01 047 discloses a double flat spring contact comprising a back-up spring integrally incorporated in the contact and formed in one piece with the same. The base part of this contact is divided, with the thus formed side walls being connected to each other with stability in terms of shape via two connecting lugs. The connecting lugs have a recess and a dovetail-like projection, respectively, that is wedged into said recess.

[0006] This type of connection also entails the disadvantage that it may become released in case of torsion or strong mechanical loads acting on the back-up spring.

[0007] It is thus the object of the invention to indicate for a socket contact of the type indicated at the outset a back-up spring having an as stable as possible closed box-shape that can be manufactured without additional working expenditure.

[0008] This object is met according to the invention in that the other wall section is formed with a recess for each connecting lug and that the connecting lugs are passed through the recesses and bent over, and the two wall sections overlap over the full length of the back-up spring.

[0009] This type of connection can easily be produced on a stamping and bending machine. The connecting lugs to this end are bent over first by 90° so that they protrude outwardly. Thereafter, the other wall section with the recesses is bent over the protruding connecting lugs such that the connecting lugs extend through the recesses. By bending over the upper portion of the connecting lugs, the wall halves of the divided fourth wall are connected to each other with stability in shape.

[0010] Due to the fact that the wall halves overlap over the entire length of the back-up spring, a closed box-shape is obtained and the stability of the connection

is increased considerably. By said overlapping, the upper wall section is clamped between the bent portion of the connecting lugs and the lower wall section. The clamping effect adds a frictional component to the positive connection.

[0011] The wall halves thus are firmly connected to each other both in the longitudinal and in the transverse direction of the back-up spring. Also in case of high mechanical loads, such as e.g. torsion or stepping-on loads of the back-up spring, there is thus no risk that the connection of the wall halves will become disengaged.

[0012] The recesses preferably are formed in the upper wall section in the form of elongate holes. At least one recess, however, may also be formed as U-shaped recess on the terminal-side or contact-side edge of the upper wall section.

[0013] The provision of the recesses in the form of elongate holes has the advantage that the connecting lugs, after bending, can be formed into a shape such that they are supported on the walls of the recesses.

[0014] The deformation of the connecting lugs suitably takes place by pressing together or introducing one or more notches on the upper side of the connecting lugs.



[0015] To enclose the base spring in as stable manner as possible, it is necessary to keep the contact area between back-up spring and base spring as large as possible. To this end, the upper wall section, in front of the overlapping portion, is advantageously formed with a crank with the material thickness of the lower wall section.

[0016] Further advantageous developments are indicated in the dependent claims.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The invention will be elucidated in more detail hereinafter by way of an embodiment depicted in the drawings, in which

[0018] Fig. 1 shows a perspective view of a socket contact looking onto the divided fourth wall;

[0019] Fig. 2 shows a corresponding view of the socket contact looking onto the first wall;

[0020] Fig. 3 shows a perspective view of a further modification of the back-up spring looking onto the divided fourth wall;

[0021] Fig. 4 shows a cross-sectional view of a contact cavity of a contact carrier receiving a socket contact; and

[0022] Fig. 5 shows a partial sectional view of the contact region of the socket contact.

~~Figs. 1 and 2 illustrate a socket contact 1 consisting of a base spring 2 and a back-up spring 3. The entire~~

#### DETAILED DESCRIPTION OF THE DRAWINGS

[0023] Figs. 1 and 2 illustrate a socket contact 1 consisting of a base spring 2 and a back-up spring 3. The entire socket contact 1 is inserted into a contact cavity 4 of a contact carrier 5 (cf. Fig. 4), e.g. a socket housing of an electrical connector assembly with single-row or multi-row contact cavities. The base spring 2 is formed with a terminal section 6, e.g. in the form of a crimp-type terminal, for an electric conductor and with a contact section 7 having a spring leg base 8 of e.g. U-shaped or rectangular design in cross-section, from which extend the spring legs 9 and 10 (cf. Fig. 5) for establishing contact with a plug-type contact, e.g. a contact blade. The spring legs 9 and 10 of the base spring 2 originate ~~e.g., in the~~ disclosed embodiment, from the top wall and the bottom wall of a spring leg base 8 of rectangular cross-section and. The spring legs may be designed as ordinary forked spring arms or double flat spring contacts, but may also have a plurality of contact lamellas on each spring leg by providing longitudinal slots. In case of the socket contact 1 illustrated, each spring leg 9, 10 has four contact lamellas.

[0024] The back-up spring 3 also is of rectangular cross-section so that it encloses the entire contact section 7 of

the base spring 2 with four walls 11 to 14 in box-shaped manner. The first wall 11 constitutes the top wall, the second and third walls 12, 13 constitute the side walls, and the fourth wall 14 represents the bottom wall. In the lower partial region of the first wall 11 facing the terminal section 6 of base spring 2, there is formed an outwardly bent locking hook 15 as primary locking feature for a socket contact 1 to be inserted into a contact cavity 4 of contact carrier 5. Locking hook 15, on its outer face side in the middle thereof, has an outwardly projecting bulge 16 and is provided with an impressed portion 17 on both sides of the bulge 16. Due to the impressed portions 17, there are formed relatively sharp edges on the face side of locking hook 15 which contribute in that the locking hook 15 provides for better fixation of the socket contact 1 in the contact cavity 4. The outwardly directed bulge 16 in locking hook 15 also contributes in providing improved fixation of socket contact 1 in contact cavity 4.

**[0025]** For providing the effect that the locking hook 15 is pressed against the inner wall of contact cavity 4 as strongly as possible, there is provided a reinforcing bead 18 in the bending line between the locking hook 15 and the first wall 11. The reinforcing bead 18 aggravates bending back of the locking hook 17 towards the first wall 11.

**[0026]** For fixing the back-up spring 3 on the base spring 2, the second and third walls 12, 13 of back-up spring ~~33~~ are formed with folding lugs 19, 20 formed by separating cuts, which engage in corresponding openings 21, 22 in the side walls of the spring leg base 8.

[0027] The base spring 2 and the back-up spring 3 are stamped and bent sheet metal members and thus are divided into two in one wall for manufacturing reasons.

[0028] In case of back-up spring 3, the fourth wall 14 is divided into two and consists of the two wall sections 14a and 14b. For obtaining a stable closed box-shape, the wall sections 14a and 14b are connected to each other in the manner elucidated hereinafter.

[0029] The wall sections 14a and 14b overlap over the entire length of back-up spring 3. Due to such overlapping, there is formed a lower wall section 14a and an upper wall section 14b. The lower wall section 14a has two connecting lugs 23 formed thereon which are bent upwardly by  $90^\circ$  and are passed through corresponding recesses 24 in the upper wall section 14b. For providing a positive or form-fit connection of the wall sections 14a and 14b, the connecting lugs 23, after having been passed through the recesses 24, are bent over once more by  $90^\circ$  so that the upper wall section 14a is clamped between the bent over upper portion of the connecting lugs 23 and the lower wall section 14a.

[0030] In bending over the upper portion of the connecting lugs 23, these are press-fit such that the connecting lugs 23 are urged against the side walls of opening 24. By doing so, any possibility of movement of the wall sections 14a and 14b relative to each other is excluded after press-fitting. In addition to or as an alternative to press-fitting, the top sides of the bent over connecting lugs 23 may be provided with notches 25 so

that the connecting lugs become broader in the longitudinal direction of the back-up spring 3 and are also pressed against the side walls of the recesses 24. The notches 25 are arranged perpendicularly to the longitudinal direction of the back-up spring 3.

[0031] The two connecting lugs 23, through which wall sections 14a and 14b are connected to each other, are arranged substantially in the front and rear portions of the lower wall section 14a as seen in the direction of insertion of socket contact 1.

[0032] The connecting lug 23 located closer to the terminal section 6 of the base spring 2 is of considerably broader configuration and is provided on the top side thereof with two or more notches 25.

[0033] In order for the back-up spring 3 to enclose the rectangular base spring 2 almost completely, the upper wall section 14b is bent by a crank 26 in front of the portion overlapping with the lower wall section 14a.

[0034] On the face side of the lower wall section 14a facing in insertion direction, there is arranged an additional lug 27 that is also bent upwardly by  $90^\circ$  and the somewhat broader upper portion thereof is folded back downwardly by  $180^\circ$ . The upper folded portion of lug 27 constitutes a polarizing member 28 for the socket contact 1, so as to prevent erroneous insertion of the socket contact 1 into the contact cavity of a contact carrier. Lug 27 is

laterally offset from the longitudinal axis of the back-up spring 3. The upper folded portion is broadened in the direction towards the longitudinal axis of the back-up spring 3, but still is arranged laterally offset from the longitudinal axis of the back-up spring 3. However, it may also be arranged centrally with respect to the longitudinal axis of the back-up spring 3 so as to be matable with the contact cavity 4 as shown in Fig. 4. As shown by the sectional view in Fig. 4, the contact cavity 4 of contact carrier 5 is formed with a corresponding polarizing groove 29 for polarizing member 28.

[0035] In order to not hinder insertion of socket contact 1 into the contact cavity 4 of contact carrier 5, the dimensions of polarizing member 28 transversely of the direction of insertion are smaller than those of the polarizing groove 29.

[0036] On the divided fourth wall 14 and on the first wall 11 of the back-up spring 3, there is formed, for each spring leg 9, 10 of the back-up spring 3, an inwardly bent back-up spring tongue 30 which abut on the spring legs 9, 10 approximately at the height of the contact region 31 (cf. Fig. 5).

[0037] Fig. 3 shows an additional modification of the back-up spring 3. The connection of wall sections 14a and 14b is effected both on the terminal side and on the contact side via two connecting lugs 23 of equal width, which are provided with only one impressed portion 25 each on their top side. The terminal-side recess 24 in

upper wall section 14a is of U-shaped configuration. The locking hook 15 is formed on the terminal-side edge of the first wall 11 and is produced by two cuts 32, 33 starting from the face side of the first wall 11 that is directed towards terminal section 6.

~~Abstract~~

~~Socket Contact~~

## ABSTRACT

The invention relates to a socket contact (1) ~~consisting of~~ including a back-up spring (3) and a base spring (2), the back-up spring (3) enclosing the base spring (2) in box-like manner with a first wall (11), a second wall (12), a third wall (13) and a divided fourth wall (14). The wall sections (14a, 14b) of the fourth divided wall (14) are connected to each other in positive fitting manner. On one wall section (14a), there are formed at least two connecting lugs (23) arranged in the front and rear portions of the wall section (14a) as seen in the direction of insertion of the socket contact (1). The other wall section (14b) is formed with a recess (24) for each connecting lug (23), and the connecting lugs (23) are passed through ~~said~~ the recesses (24) and bent over. For increased stability, the two wall sections (14a, 14b) overlap over the full length of the back-up spring (3).